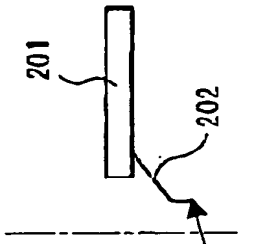


**This invention**

**Probe Card**

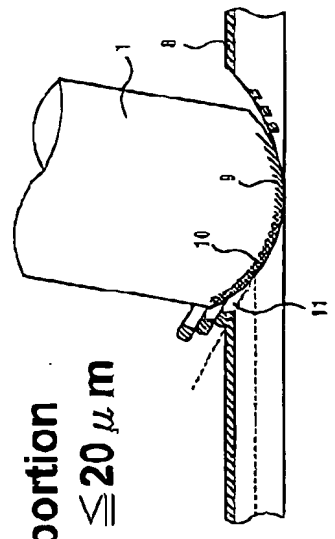
**Fig.13A**

**A plurality of tips**



**Tip portion**

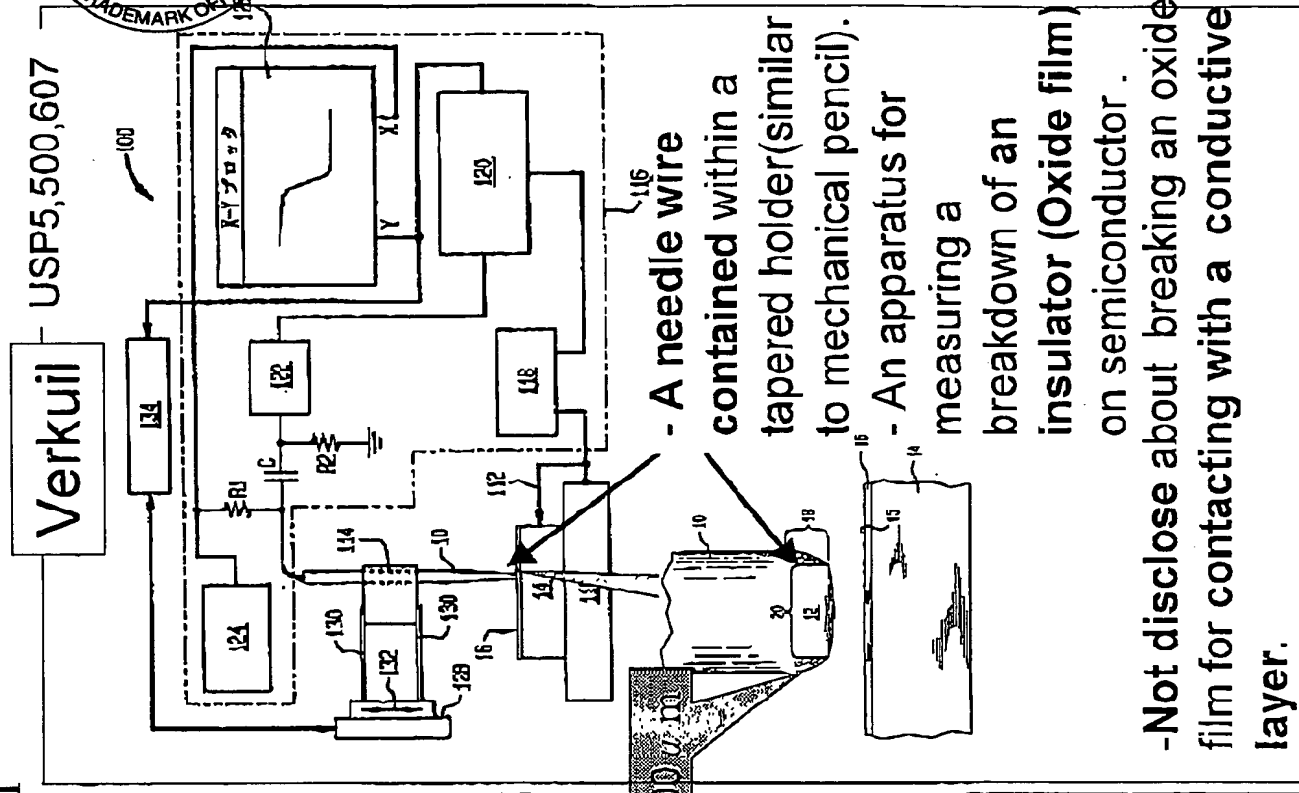
$$10 \leq r \leq 20 \mu m$$



**Fig.2**

- Tip portions are urged against a plurality of metal pads.
- A probe card for testing an electrical characteristic of a semiconductor device
- A tip breaks an oxide film on a metal pad and the tip contacts with a conductive layer.

**FIG.1**



**Verkuil**

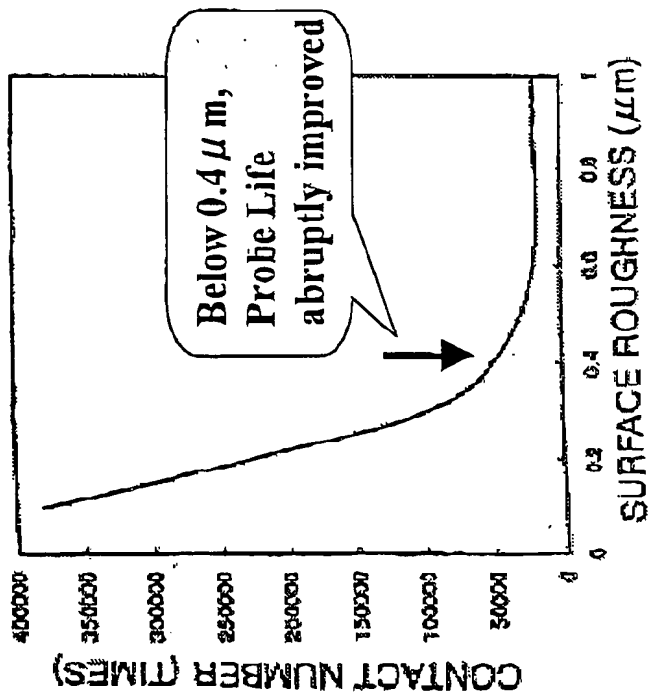
USP5,500,607



- A needle wire contained within a tapered holder(similar to mechanical pencil).
- An apparatus for measuring a breakdown of an insulator (Oxide film) on semiconductor.
- Not disclose about breaking an oxide film for contacting with a conductive layer.

FIG.2

This invention



- Teach an effective roughness and radius.

- $10 \mu m \leq r \leq 20 \mu m$  roughness  $\leq 0.4 \mu m$ .
- A spherical tip can occur shear deformation successfully, and break and drive out oxide thin film on metal pad. Therefore tip can contact with a conductive layer.

Kusumoto

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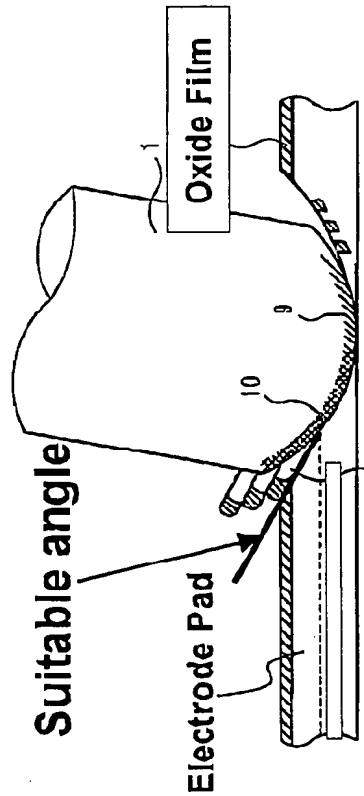
電解液		電解条件		表面粗さ	
濃度 (g/l)	先端部曲率	最終電圧 (V)	時間 (秒)	最大粗さ (μm)	Ry (μm)
OH 10	3 R	-	-	0.90	0.93
H 20	0.6 R	-	-	0.80	0.90
OH 10	2.5 R	0.2	5	0.65	0.61
OH 15	4 R	0.1	3	0.85	0.92
H 30	1 R	0.2	5	<u>0.60</u>	0.69
-	-	-	-	3.30	-
-	-	-	-	3.55	-
-	平面	-	-	6.55	6.90
-	-	-	-	2.30	2.53

Roughness

- Disclose a probe having a surface roughness of  $0.6 \mu m$
- Not disclose a probe having a surface roughness equal to or less than  $0.4 \mu m$ .
- Never teach an effective roughness and radius of a tip.

FIG.3

# This invention



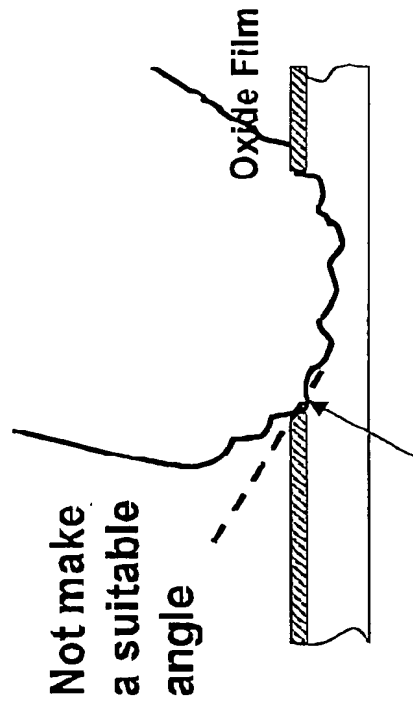
- Suitable radius[r] and roughness of tip

$$10 \mu m \leq r \leq 20 \mu m$$

$$\text{roughness} \leq 0.4 \mu m$$

make a shear deformation successfully, break and drive out oxide thin film on metal pad.

# Conventional



This portion prevents to make a lamination stack

- Conventional tip

Not make a shear deformation, Not break and drive out oxide thin film on metal pad.